

Description

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an elastic part 5 which holder is used in an apparatus for mounting a rubber plug on an end of a wire for a water entry preventing purpose, and to a method for inserting a wire into a rubber plug.

In general, in order to prevent entrance of rain, etc. into connectors mounted at ends of a wiring harness installed, for example, in an engine compartment of an automotive vehicle, rubber plugs 3 are mounted at ends of wires 1 at the same time when terminal fittings 2 are 10 cramped with the ends of the wires 1 as shown in FIG. 6.

The rubber plug 3 has a substantially hollow cylindrical form, and an inner diameter thereof is slightly smaller than an outer diameter of the wire 1. Thus, the rubber plug 3 is elastically in close contact with the outer surface of the wire 1, thereby preventing water from entering between the outer surface of the wire 1 and the rubber plug 3.

When the rubber plug 3 is mounted on the wire 1, the inner diameter of the rubber plug 3 is made larger as the wire 1 is inserted into the rubber plug 3, with the result that the rubber plug 3 undergoes an elastic deformation in its radially outward direction. 25

This rubber plug can be mechanically mounted as disclosed in Japanese Unexamined Patent Publication No. 5-266959. Specifically, the rubber plug is held in a seal holder and a wire is retained by a clamp. By moving the clamp forward in this state, the wire is inserted into the rubber plug. 30

Since the seal holder holds the rubber plug around its outer surface, looseness is produced if a clearance between the outer surface of the rubber plug and the inner surface of the seal holder is large, with the result that the rubber plug cannot be accurately positioned in a wire inserting direction. Accordingly, the wire to be inserted comes into contact with the front end of the rubber plug, and thus cannot be inserted into the insertion hole formed in the rubber plug. This leads to a defective insertion of the wire into the rubber plug. 35

On the other hand, if there is no clearance between the outer surface of the rubber plug and the inner surface of the seal holder, the rubber plug can be accurately positioned and therefore the wire can be inserted. However, such a holder does not permit the elastic deformation of the rubber plug in its radially outward direction which results from the insertion of the wire. This leads to an increase in the resistance created by the insertion of the wire, which may bend the wire. Thus, the wire may not be securely inserted. 40

Even if the wire can be inserted, since the elastic deformation of the rubber plug in its radially outward direction is not permitted, the inner surface and the peripheral portion of the rubber plug may be deformed in the wire inserting direction due to the frictional resist-

ance between the outer surface of the wire and the inner surface of the rubber plug. This deformation may remain even after the insertion of the wire. Because of the remaining deformation, the inner surface of the rubber plug may be partially out of contact with the outer surface of the wire, or the rubber plug may be displaced along the wire when the remaining deformation is released at once upon disengaging the rubber plug from the seal holder after the insertion of the wire. As a result, the water preventing performance of the rubber plug may be deteriorated. 10

An object of the invention is to provide a seal holder capable of accurately positioning a rubber plug in a predetermined position and permitting an elastic deformation of the rubber plug in its radially outward direction which results from the insertion of a wire, so that the mounting of the rubber plug on the wire at its end can be smoothly and securely performed. 15

The above object is accomplished by the invention defined in claims 1, 8 and 9, respectively. 20

In the above construction, the contact holding portion embraces or surroundingly holds the holding portion of the elastic part (hereafter, referred to as rubber plug), with the result that the rubber plug is held and positioned in the rubber plug holder. When the elongate part (hereafter, referred to as wire) is inserted into the held rubber plug, the rubber plug is elastically deformed in its radially outward direction. The elastic deformation caused thereby at the holding portion of the rubber plug is taken up by the deformation permitting portion. Thus, during the wire insertion, the rubber plug is not deformed in its radially inward direction, i.e., in such a direction as to tighten the wire being inserted. Conclusively, the wire insertion can be smoothly and securely performed without increasing the resistance caused thereby. 25

Preferably, the holder comprises a positioning portion for restricting the movement of the rubber plug in a wire inserting direction while the rubber plug is held. Thereby, an axial movement of the rubber plug resulting from the insertion of the wire into the rubber plug can be securely restricted by the positioning portion. This realizes the more smooth wire insertion and the accurate mounting of the rubber plug in the predetermined position of the wire. As a result, problems resulting from the displacement of the rubber plug during the cramping of the terminal fitting can be advantageously prevented. 30

It is further preferred that the deformation permitting portion is formed in the contact holding portion and comprises an annular groove having an opening facing the holding portion of the rubber plug when the contact portion embraces the holding portion. 35

Thereby, an elastic radially outward deformation of the holding portion direction is taken up by entry of material of the rubber plug into the annular groove through its opening. Thus, during the wire insertion, the rubber plug is not deformed in its radially inward direction, i.e., in such a direction as to tighten the wire being inserted. Particularly, there is an advantage that the deformation permit-

ting portion can be easily formed by the annular groove formed in the contact holding portion.

Preferably, the annular groove is formed intermediate the contact holding portion so that portions of the contact holding portion at the opposite sides of the opening of the annular groove come into contact with the holding portion of the rubber plug.

Since the annular groove is formed intermediate the contact holding portion, portions of the contact holding portion at the opposite sides of the opening of the annular groove come into contact with the holding portion of the rubber plug. In other words, the holding portion of the rubber plug is supported or held in two positions by the contact holding portion. Thus, the rubber plug can be more stably held with its longitudinal axis along the wire inserting direction. This enables the more smooth and secure wire insertion.

As an alternative, it is preferred that the deformation permitting portion is formed by a large diameter portion which is contiguous with the contact holding portion, extends beyond the contact holding portion in the wire inserting direction, and has an inner diameter larger than an outer diameter of the holding portion of the rubber plug. Preferably, the holder further comprises a main portion holding portion for coming into contact with a main portion of the rubber plug, which main portion is preferably contiguous with the holding portion of the rubber plug and has a large diameter compared therewith.

Particularly, the large diameter portion provides a large space for taking up the elastic radially outward deformation. Accordingly, even if the elastic deformation becomes larger, it can be securely taken up. Thus, during the wire insertion, the deformation of the rubber plug in its radially inward direction, i.e., in such a direction as to tighten the wire being inserted can be more securely prevented. As a result, the wire insertion can be more smoothly and securely performed. Further, the main portion of the rubber plug can be held by the main portion holding portion.

These and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and accompanying drawings in which:

FIG. 1 is an enlarged front view partially in section showing a state where a rubber plug is held by a seal holder before the insertion of a wire,

FIG. 2 is an enlarged front view partially in section showing a state where the wire is inserted into the held rubber plug,

FIG. 3 is a diagram showing a wire end processing apparatus including the seal holder according to one embodiment of the invention,

FIG. 4 is a section of a seal holder as a modification of the invention,

FIG. 5 is a section of a seal holder as another modification of the invention, and

FIG. 6 is a front view showing a rubber plug and a terminal fitting mounted at an end of a wire.

FIG. 3 diagrammatically shows a wire end processing apparatus 4 including a rubber plug holder (hereinafter, "seal holder") 12 according to the embodiment of the invention. FIG. 1 is an enlarged front view partially in section showing a state where a rubber plug 3 is held by the seal holder 12 before the insertion of the wire. FIG. 2 is an enlarged front view partially in section showing a state where a wire 1 is inserted into the held rubber plug 3.

With reference to FIG. 3, the processing apparatus 4 is adapted to mount the rubber plug 3 on the wire 1 at its end and to peel the sheath of the wire 1 at its end, and includes a transferring mechanism 8, a holding mechanism 9 and a clamping mechanism 10. The transferring mechanism 8 transfers the rubber plugs 3 fed in line along a feeding path 5 by a parts feeder (not shown) from a receiving position 6 to a mounting position 7. The holding mechanism 9 tightly holds the rubber plug 3 from the opposite sides in the mounting position 7. The clamping mechanism 10 grips a wire 1 cut into a specified length by a wire cutting mechanism (not shown) and places it on the longitudinal axis of the rubber plug 3 in the mounting position 7.

The transferring mechanism 8 is moved backward and forward and includes a rod 11 which is inserted into a wire insertion hole 3c formed in the rubber plug 3 (see FIG. 1) to transfer the rubber plug 3. The rod 11 is mounted on a base portion 11a which is rotated between the receiving position 6 and the mounting position 7.

The holding mechanism 9 includes a seal holder 12 for tightly holding a neck portion or holding portion 3a of the rubber plug 3 from the opposite sides. The seal holder 12 consists essentially of a pair of holding members 12a and 12b, which are moved by cylinders 19a and 19b, respectively, between a contact position where they abut against each other and a spaced position where they are apart from each other.

As shown in FIGS. 1 and 2, a rubber plug chamber 22 is formed in the seal holder 12 when the holding members 12a and 12b are in the contact position. The contour of the chamber 22 is in conformity with the outer configuration of the rubber plug 3. In the chamber 22, there are formed a contact holding portion 13 which is in contact with the neck portion 3a when the rubber plug 3 is accommodated in the chamber 22, and a main portion chamber 15 for accommodating a main portion 3b of the rubber plug 3. The chamber 15 has a diameter larger than that of the contact holding portion 13, and is in communication with the contact holding portion 13. The chamber 15 has such a shape corresponding to the main portion 3b that different kinds of rubber plugs each having an identical neck portion as a holding portion 3a and a different main portion 3b can be accommodated in the chamber 15.

The contact holding portion 13 is formed such that its inner diameter is slightly smaller than the outer diameter of the neck portion 3a of the rubber plug 3. The contact holding portion 13 holds the rubber plug 3 in close contact therewith. In the inner surface of the contact hold-

ing portion 13, there is formed an annular groove 14 as a deformation permitting portion for permitting an elastic deformation (particularly, a radially outward deformation) produced while the rubber plug 3 is held in close contact.

The annular groove 14 is open to and faces an intermediate portion of the neck portion 3a of the rubber plug 3 when the rubber plug 3 is accommodated in the chamber 22. Thus, the rubber plug 3 is held in contact with portions 13a and 13b of the contact holding portion 13 at the opposite sides of the annular groove 14.

Identified by 16 is a guide member disposed before the seal holder 12. The guide member 16 is formed with a guide hole 17 for guiding the wire 1 along the longitudinal axis of the rubber plug 3 held by the seal holder 12, and a guide surface 18 which slants outward from the guide hole 17.

Referring back to FIG. 3, the clamping mechanism 10 has a pair of chucks 20a and 20b which are openably and closably driven by a driving mechanism (not shown) to hold and reciprocatingly move the wire 1. More specifically, the wire 1 held by the chucks 20a and 20b is intermittently and reciprocatingly moved between a wire inserting position 21 on the longitudinal axis of the held rubber plug 3, a wire measuring position (not shown) which is located at the side of the position 21 and where the wire is measured and cut before being inserted, and a cramping position (not shown) where a terminal fitting is cramped with the wire 1 having its sheath peeled by a pair of peeling blades 22a and 22b.

Next, the mounting of the rubber plug 3 by the wire end processing apparatus 4 is described.

(1) With reference to FIG. 3, the rod 11 of the transferring mechanism 8 is inserted into the wire insertion hole 3c of the bottommost one of the rubber plugs 3 fed in line along the feeding path 5 in the receiving position 6, thereby transferring the rubber plug 3 to the rod 11.

(2) Subsequently, the rod 11 is rotated to convey the rubber plug 3 to the mounting position 7.

(3) The cylinders 19a and 19b are operated to bring the holding members 12a and 12b into abutment against each other, thereby accommodating the rubber plug 3 in the seal holder 12.

With reference to FIG. 1, at this stage, the neck portion 3a of the rubber plug 3 is held by the contact holding portion 13.

(4) The rod 11 is returned to its original position to receive the next rubber plug 3.

(5) Upon the completion of the transfer of the rubber plug 3, the clamping mechanism 10 grips and conveys the wire 1 cut into a specified length to the wire inserting position 21. At this stage, the chucks 20a and 20b move forward toward the seal holder 12, thereby inserting the wire 1 into the wire insertion hole 3c of the rubber plug 3 through the guide hole 17 while being guided by the guide surface 18 of the guide member 16.

According to this embodiment, as shown in FIG. 1, the neck portion 3a of the rubber plug 3 is held around its outer surface by the contact holding portion 13 to hold the rubber plug 3 in the seal holder 12. Since the rubber plug 3 is held in close contact by the seal holder 12, it can be held in a predetermined position in the seal holder 12.

When the wire 1 is inserted into the held rubber plug 3, the rubber plug 3 is elastically deformed in its radially outward direction as shown in FIG. 2. This elastic deformation is taken up by the annular groove 14. Particularly in this embodiment, the elastic deformation is taken up by entering the annular groove 14 through its opening. Accordingly, when the wire 1 is being inserted, the rubber plug 3 is not deformed in its radially inward direction, i.e., in such a direction as to tighten the inserted wire 1. Thus, the wire 1 can be smoothly inserted without increasing the resistance created thereby.

Further, since the annular groove 14 is formed in an intermediate position of the contact holding portion 13 and the neck portion 3a of the rubber plug 3 is supported in two positions by the portions 13a and 13b at the opposite sides of the annular groove 14, the rubber plug 3 can be stably held with its longitudinal axis extending along the inserting direction of the wire 1. Thus, the wire 1 can be further smoothly inserted.

Next, modifications of the seal holder are described.

FIG. 4 is a section showing a state where the rubber plug is held by a seal holder 12 as a first modification.

With reference to FIG. 4, the characteristics of the seal holder 12 according to this modification are:

- (1) a deformation permitting portion of the seal holder 12 is continuous with a contact holding portion 13 and extends in the wire inserting direction,
- (2) the deformation permitting portion is formed by a large diameter portion 14a having an inner diameter larger than an outer diameter of the neck portion 3a of the rubber plug 3, and
- (3) A main portion holding portion 23 is formed which comes into contact with and holds the main portion 3b of the rubber plug 3 continuous with the neck portion 3a thereof when the rubber plug 3 is held.

The other construction of the seal holder 12 is same as the foregoing embodiment.

More specifically, the large diameter portion 14a extends to the rear edge of the seal holder 12 while leaving the contact holding portion 13 only at a portion corresponding to a contiguous transitional portion between the neck portion 3a and the main portion 3b, so that the rear part of the neck portion 3a is out of contact with the contact holding portion 13.

This modification has the same action and effects as the foregoing embodiment. Particularly, since the large diameter portion 14a provides a larger space for taking up the elastic deformation of the rubber plug 3 than the holder shown in FIGS. 1 and 2, even if the elastic deformation becomes larger, it can be securely taken up.

Accordingly, during the insertion of the wire 1, the deformation of the rubber plug 3 in its radially inward direction, i.e., in such a direction as to tighten the wire 1 being inserted can be more securely prevented. As a result, the wire insertion can be more smoothly performed.

Further, since the main portion 3b of the rubber plug 3 is held by the holding portion 23, the posture of the rubber plug 3 is properly maintained during the wire insertion. In other words, the rubber plug will not tilt with respect to its axis when the wire is inserted. Thus, the wire insertion can be more smoothly performed. Due to the fact that the volume of the main portion 3b is larger than that of the neck portion 3a, the wire can be inserted smoothly although the main portion 3b is held by the holder portion 23.

However, it is not possible to use this type of holder for different kinds of plugs as is possible with the holder shown in FIGS. 1 and 2.

Next, a second modification is described.

FIG. 5 is a section showing a state where the rubber plug is held by a seal holder according to the second modification.

With reference to FIG. 5, the characteristics of the seal holder 12 according to this modification are:

- (1) A large diameter portion 14b as a deformation permitting portion is so formed as to leave the contact holding portion 13 only at a portion corresponding to a contiguous transitional portion between the neck portion 3a and the main portion 3b, and
- (2) A positioning portion 24 is formed beyond the large diameter portion 14b and in contact with an end face 3d of the neck portion 3a when the rubber plug 3 is held by the seal holder 12.

The other construction is same as the foregoing embodiment.

This modification has the same action and effects as the foregoing embodiment. In addition, the positioning portion 24 securely restricts the movement of the rubber plug 3 during the insertion of the wire into the rubber plug 3. Thus, the rubber plug 3 can be securely fixed during the wire insertion, thereby enabling an even smoother wire insertion. Further, since the rubber plug 3 can be accurately mounted in the predetermined position of the wire 1, problems resulting from the displacement of the rubber plug 3 during the cramping of the terminal fitting can be advantageously prevented.

The invention is not limited to the foregoing embodiment and modifications. For example, the positioning portion 24 may be formed in the contact holding portion 13 of the seal holder 12 according to the foregoing embodiments.

LIST OF REFERENCE NUMERALS

- | | |
|----|--------------|
| 1 | Wire |
| 3 | Rubber Plug |
| 3a | Neck Portion |

- | | |
|-----|---|
| 3b | Main Portion |
| 12 | Seal Holder (Rubber Plug Holder) |
| 13 | Contact Holding Portion |
| 14 | Annular Groove (Deformation Permitting Portion) |
| 14a | Large Diameter Portion |
| 14b | Large Diameter Portion |
| 23 | Main Portion Holding Portion |

10 Claims

1. A holder for an elastic material part (3) having

- a hole (3c) into which an elongate part (1) is to be inserted, and
- a holding portion (3a) at which the elastic part (3) is to be held,

the holder (12) comprising a contact holding portion (13) for holding the elastic part (3) by embracing the holding portion (3a) thereof, wherein the contact holding portion (13) comprises a deformation permitting portion (14;14a;14b) for permitting an elastic deformation of the elastic part (3) in its radially outward direction, which deformation is caused when the elongate part (1) is inserted into the hole (3c) of the elastic part (3) held by the contact holding portion (13).

2. A holder according to claim 1, further comprising a positioning portion (24) for restricting the movement of the elastic part (3) in an inserting direction of the elongate part (1) while the elastic part (3) is held.

3. A holder according to claim 1 or 2, wherein the deformation permitting portion is formed in the contact holding portion (13) and comprises an annular groove (14) having an opening facing the holding portion (3a) of the elastic part (3).

4. A holder according to claim 3, wherein the annular groove (14) is formed in the middle of the contact holding portion (3a) so that portions (13a,13b) of the contact holding portion (3a) at opposite sides of the opening of the annular groove (14) come into contact with the holding portion (3a) of the elastic part (3).

5. A holder according to claim 1 or 2, wherein the deformation permitting portion is formed by a large diameter portion (14a;14b) which is arranged behind the contact holding portion (13) in an inserting direction of the elongate part (1), is formed contiguous with the contact holding portion (13), and has an inner diameter larger than an outer diameter of the holding portion (3a) of the elastic part (3).

6. A holder according to claim 5, further comprising a main portion holding portion (23) arranged before the contact holding portion (13) in the inserting

direction of the elongate part (1), for coming into contact with a main portion (3b) of the elastic part (3).

7. A holder according to claim 6, wherein the main portion (3b) is formed contiguous with and has a larger diameter than the holding portion (3a) of the elastic part (3). 5
8. A rubber plug mounting apparatus (4) for mounting a rubber plug (3) on an end of a wire (1), the apparatus comprising a transferring mechanism (8) for transferring a rubber plug (3) from a plug feeder to a mounting position (7), where the rubber plug is held by a holder according to any of claims 1 to 7, so as to allow the insertion of the wire end (1). 10 15
9. A method of inserting a wire end (1) into a through hole (3c) of a rubber plug (3) which has a large diameter main portion (3b) and a smaller diameter holding portion (3a), comprising the steps of: 20
 - transferring a rubber plug (3) from a plug feeder to a mounting position (7),
 - holding the holding portion (3a) of the rubber plug (3) at the mounting position (7), 25
 - inserting the wire end into the through hole (3c) from the side of the main portion (3b) of the rubber plug (3) while allowing a radially outward deformation of the holding portion (3a) of the rubber plug (3). 30

35

40

45

50

55

FIG. 1

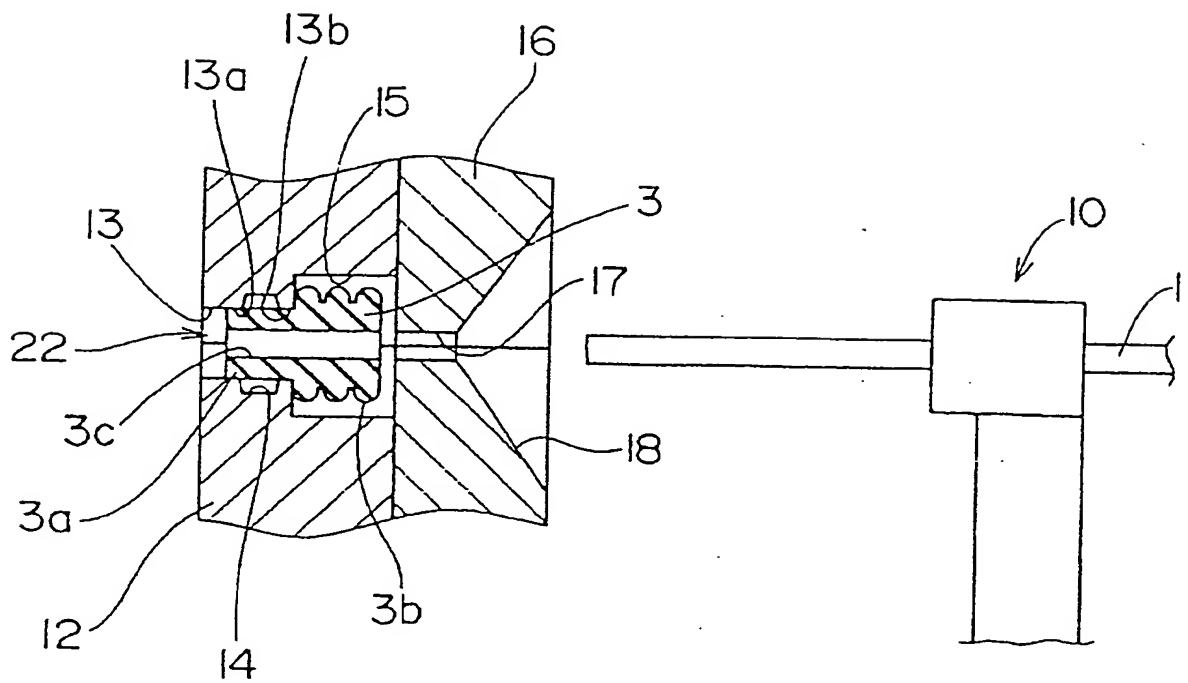


FIG. 2

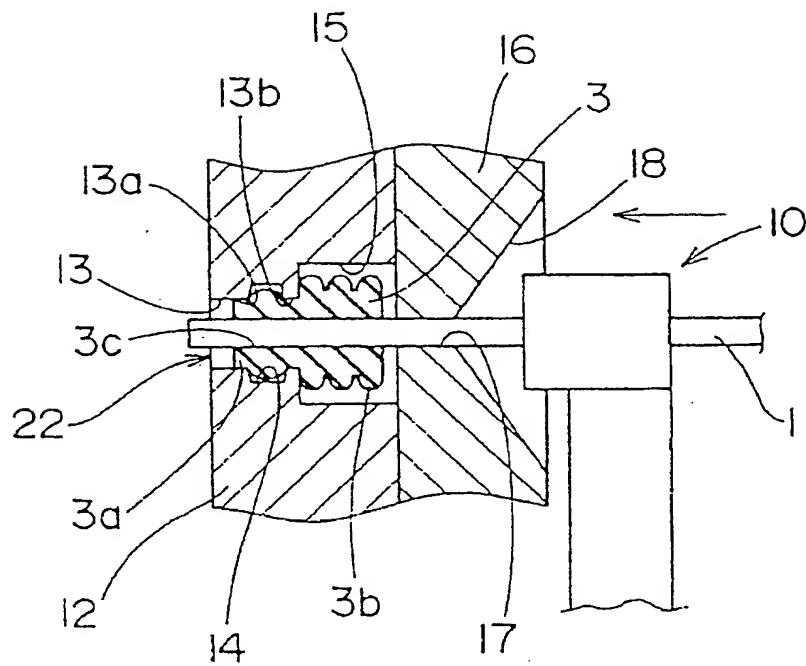


FIG. 3

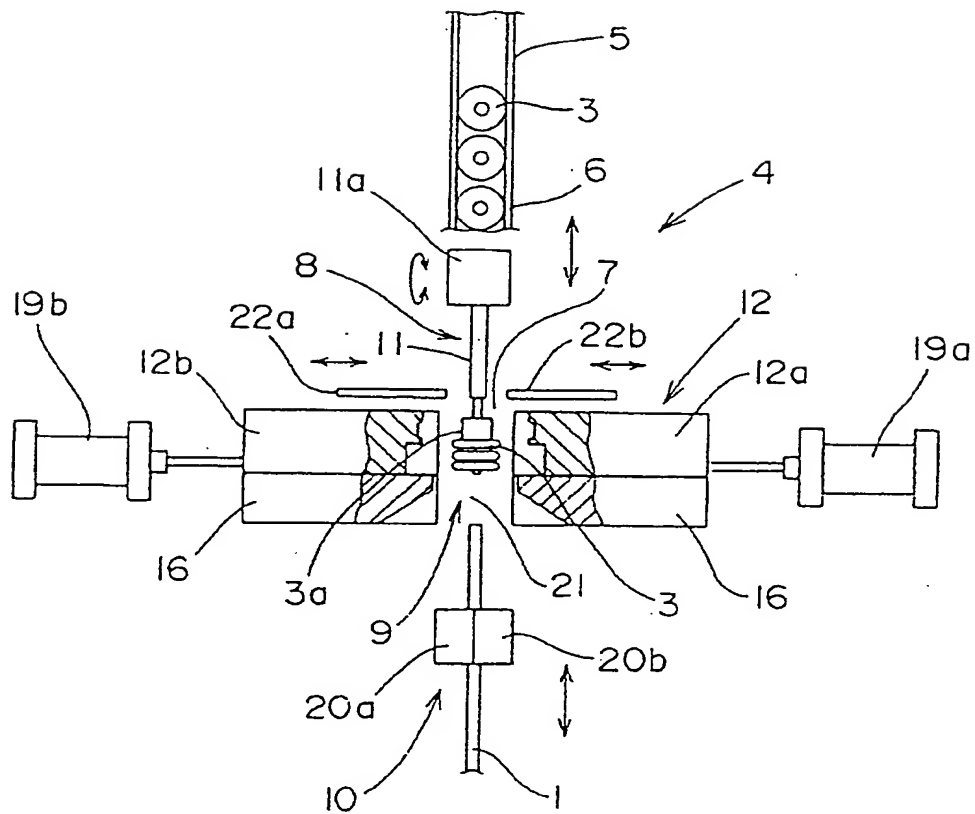


FIG. 4

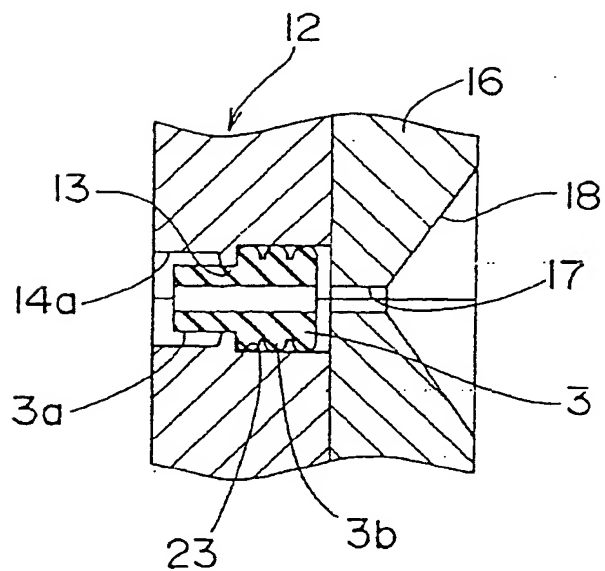


FIG. 5

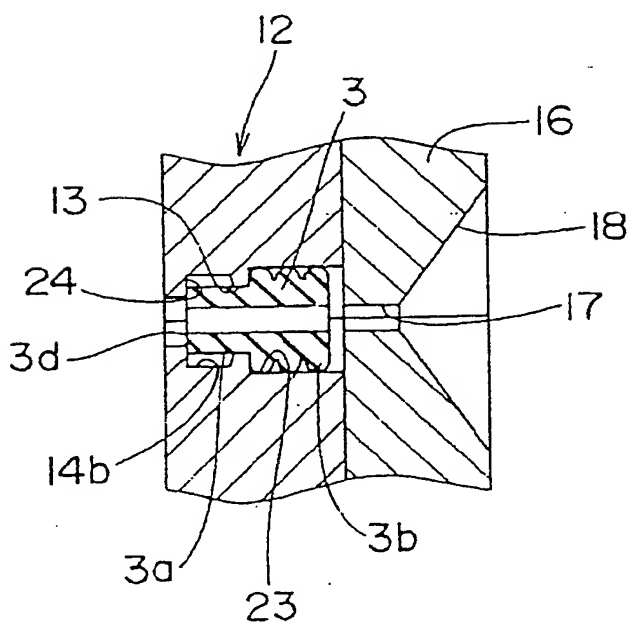
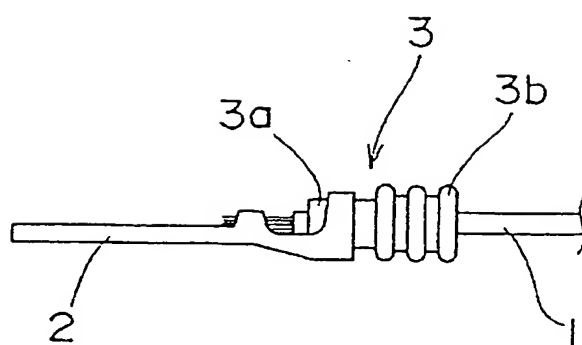


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 2245

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|---|----------------------------------|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| A | EP-A-0 159 006 (SUMITOMO) * page 14, line 5 - line 27; figures 8-11 * | 1,8,9 | H01R43/00 |
| A | EP-A-0 359 151 (YAZAKI) * column 1, line 27 - column 2, line 6 * * column 4, line 20 - line 30 * * column 4, line 47 - line 57 * * column 6, line 16 - line 31 * * column 9, line 19 - line 52; figures 12A-14 * | 1,8,9 | |
| D,A | PATENT ABSTRACTS OF JAPAN vol. 18 no. 33 (E-1493), 18 January 1994 & JP-A-05 266959 (SHIN-MEIWA) 15 October 1993, * abstract * | 1,8,9 | |
| The present search report has been drawn up for all claims | | | TECHNICAL FIELDS SEARCHED (Int.Cl.6) |
| | | | H01R |
| Place of search | | Date of completion of the search | Examiner |
| BERLIN | | 22 September 1995 | Alexatos, G |
| CATEGORY OF CITED DOCUMENTS | | | |
| <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p> | | | |

EPO FORM 1503 (04.92) (P4/C01)